

Endemic Goiter in Latin America

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Interest in the problem of endemic goiter in Latin America has been greatly stimulated by the series of FAO-WHO conferences on the nutritional problems of Latin America, held successively in Montevideo in 1948 (1), Rio de Janeiro in 1950 (2), Caracas in 1953 (3), and Guatemala City in 1957 (4). Each of these recommended that surveys for the detection of endemic goiter be carried out in all of the countries of Latin America, and made it apparent that endemic goiter was a serious public health problem in the great majority of them. As a result, a large number of surveys have been published, and the information on the distribution of endemic goiter in the hemisphere has become increasingly complete.

The report of the third Latin American nutrition conference (3) deserves special attention since a third of it was devoted to a complete analysis of the problem of endemic goiter in the Americas, including not only prevalence, contributory factors, and public health significance, but also practical details of prevention and treatment. The demonstration by Góngora and Mejía Caicedo (5) of the effectiveness of iodization of salt in the State of Caldas, Colombia, and the work of the Institute of Nutrition of Central America and Panama on the practical value of potassium iodate for the iodiza-

tion of crude, moist salt (6, 7) have widespread significance. Attention should also be given to the metabolic investigations of Stanbury (8), carried out mainly in the Province of Mendoza in Argentina. More recently, epidemiological studies carried out in Brazil (9, 10) and Ecuador (unpublished data of the National Institute of Nutrition) have shed further light on environmental factors in the occurrence of endemic goiter.

Extensive reviews of the occurrence of endemic goiter in Latin America were published in 1950 (11) and 1954 (12). A Bulletin of the World Health Organization, published in 1958 and devoted entirely to the problem of endemic goiter (13), contained a systematic survey by Kelly and Snedden of the world prevalence and geographic distribution of endemic goiter, including Latin America.

Distribution in Latin America

Argentina. Endemic goiter is prevalent in the Provinces of San Juan, La Rioja (14, 15), Catamarca, Jujuy (14-16), Córdoba, Corrientes (17), Neuquén (14, 15, 17), and Misiones (15-17). In Formosa, examination of 3,800 students showed a prevalence of 69 percent, and 38,000 students in Mendoza had a frequency of 19 percent (18). Other studies (14-16, 18, 19) have reported prevalence figures as low as 12 percent and as high as 73 percent, according to the locality. In the Province of Salta, 87 percent of the boys and 88 percent of the girls examined in a group of 1,300 students had goiters

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(20). Tucumán (1) had an average prevalence of 75 percent; 65 percent in the boys and 61 percent in the girls among the 1,800 students examined (18). It was also stated that 0.44 percent of this group were mentally retarded. Many of the authors cited cases of feeble-mindedness, cretinism, and deaf-mutism as well.

Bolivia. The most recent and complete study (21), published in 1946, gave a prevalence of 40 percent or more in the Provinces of Zudáñez, Oropeza, Azurduy, Boeto, Vallegrande, Chiquitos, and Cordillera y Tacuaremboti. In Azurduy, cases of goiter occurred among the newborn. The Tacuaremboti inhabitants were known as "los cotudos de Tacuaremboti." La Paz, Cochabamba, Potosí, and Santa Cruz described endemic goiter as frequent, and it was also observed in Oruro. In Tarija, the following frequencies were observed among the students of four localities: Ríos 60 percent, San Lorenzo 50 percent, Padcaya 30 percent, and Concepción 33 percent (22). Duguid (23) states that near the Rio Grande "all the women suffer from goiter," and Fernández (24) mentions that in the village of Cotoca, near the city of Santa Cruz, all stages of cretinism were found.

Brazil. In Matto Grosso (25, 26), as well as in Minas Gerais (27, 28), Paraná (29), Sao Paulo (30-35), and Rio de Janeiro (36), very high prevalence figures for endemic goiter have been reported. According to Lobo Leite (27), the frequency for all the State of Minas Gerais is 44 percent. Lobo Leite also encountered cretins, deaf-mutes, and the mentally deficient. A recent survey by Barca Pellon and others (37) of 866,217 school children between the ages of 5 and 17, included 20 States, 4 Territories, and the Federal District. The survey gave the following prevalence figures: north 9.4 percent, western northeast 6.0 percent, eastern northeast 0.6 percent, northeast 0.9 percent, southeast 27.0 percent, mideast 53.8 percent, and south 27.7 percent. In some of the communities surveyed the prevalence was over 80 percent.

Chile. It is probable that goiter is highly endemic in the regions situated at the foot of the mountains, along the rivers Aconcagua, Maipó, Cachapoal, and Teno (38). The disease is not restricted to the valleys of the Andes since a third of the persons examined in the

village of California had goiter, and a relatively high prevalence occurred also among the residents of Doñihue, Cerrillos, and other neighboring localities (39). Goiter occurred also in Teno, near Curicó (40), in Chimbarongo (38), and in La Punta, Province of O'Higgins (41). A survey by Donoso and others (42) of school children in the Province of Santiago, gave a prevalence of 11 percent in 39,433 examined, with variation from 0 to 37 percent. These authors believed that the prevalence of endemic goiter was increasing in Chile.

Colombia. In Colombia, the problem of endemic goiter has been recognized for many years and studied intensively. Citing only the more recent studies, Caycedo in 1946 reported goiter in 89 percent of 5,000 students in the Department of Cauca, 81 percent of 25,000 in Caldas, 67 percent of 5,000 in Boyacá, 75 percent of 200 in Santander del Sur, and 71 percent of 12,500 in Valle (43). From 1945 to 1948, almost 185,000 students from all over the country were examined and a prevalence of 53 percent was encountered (44). A subsequent report (8) classified the Departments of the Atlantic Coast, Atlantico (23 percent), Magdalena (24 percent), and Bolívar (29 percent), as zones of "low" prevalence; the Departments of Nariño (38 percent), Santander del Sur (47 percent), Valle (53 percent), and Boyacá (58 percent) as zones of "medium" prevalence; and the Departments of Huila (69 percent), Cauca (80 percent), and Caldas (81 percent) as having "high" prevalence.

Costa Rica. In 1956, Pérez and others (45) reported the results of examinations among 26,768 school children in all 7 Provinces of Costa Rica as follows: Guanacaste 26 percent, Puntarenas 20 percent, Alajuela 20 percent, Heredia 15 percent, San José 12 percent, Cartago 12 percent, and Limón 10 percent. In addition they found a higher prevalence of goiter in females than in males, and in rural areas than in urban areas.

Ecuador. An overall goiter prevalence of 50.5 percent was reported in the surveys conducted by the National Institute of Nutrition (unpublished data) among nearly 5,000 individuals from Quito and 10 rural communities in the Province of Pichincha. The prevalence in women was shown as 56 percent, in men 45

percent, and 58 percent in school children. Of the goiters recorded, 28 percent were grade 2 and nearly 14 percent were grade 3, according to the WHO classification (46). In Ecuador, cases of cretinism have been observed since 1824 (47).

El Salvador. Studies among nearly 24,000 school children in urban areas and 9,000 in rural areas, which included 14 Departments of the country, showed an average prevalence of endemic goiter of 30 percent and 29 percent respectively (48,49). One Department (Ahua-chapán) had a frequency of 26 percent in the capital city and 54 percent in rural areas. The 8,000 children examined in the National Capital had only 1 percent endemic goiter, reducing the general average. No cases of cretinism, deaf-mutism, or idiocy were reported.

Guatemala. Of the total of 39,484 persons examined in all 22 Departments, representing 1.4 percent of the population (50), 28 percent were adults, 70 percent were school children, and 2 percent preschool children. The overall goiter prevalence of 38.5 percent was the highest in Central America. The averages in each Department were: Baja Verapaz 64 percent, Chimaltenango 59 percent, Sacatepéquez 56 percent, San Marcos 54 percent, Totonicapán 45 percent, Quiché 44 percent, Alta Verapaz 42 percent, Santa Rosa 39 percent, Retalhuleu 38 percent, Suchitepéquez 37 percent, Sololá 37 percent, Huehuetenango 37 percent, Jutiapa 36 percent, Escuintla 34 percent, Chiquimula 33 percent, Quezaltenango 30 percent, Progreso 30 percent, Guatemala 28 percent, Zacapa 22 percent, Jalapa 22 percent, Izabal 20 percent, and Petén 7 percent. The prevalence of endemic goiter tended to increase with altitude.

Honduras. A survey by Borjas (51) on 12,644 persons in 15 Departments showed an overall prevalence of 22 percent with the following age distribution: children, ages 6 to 12, showed a frequency of nearly 16 percent in boys and 23 percent in girls, while in the adolescent group, 13 to 18 years, the frequency was 19 percent in boys and 30 percent in girls. In adults, 19 years and over, there was a frequency of 52 percent in males and 41 percent in females. Departments with the highest prevalence rates were: Lempira 46 percent, Santa Bárbara 43 percent, Francisco Morazán 41 percent, Valle

36 percent, Choluteca 23 percent, La Paz 18 percent, Ocotepeque 17 percent, Copán 15 percent, and El Paraíso 13 percent.

Mexico. Stacpoole (52) reported that in more than 1 million persons in the eight central States there was an overall prevalence of 19 percent. On the basis of reports of public health physicians, he believed that, except for Lower California, the whole country was affected, although the frequency was less in the north central and coastal States. He estimated that at least 3 million persons in Mexico had endemic goiter.

Nicaragua. Arce Paiz and Pérez (53,54) reported a prevalence of 26.5 percent among 15,500 persons in a survey covering the whole country. The prevalence was over 30 percent in the Departments of Chinandega, Estelí, Madriz, Matagalpa, Nueva Segovia, and Rivas; 20-30 percent in the Departments of Carazo and Managua; and 10-20 percent in the remaining five Departments of Boaco, Chontales, Jinotega, León, and Masaya.

Panamá. W. Ascoli and his associates have reported in unpublished data that in 1958 a national survey of 7,578 school children showed an overall prevalence of 31.5 percent. The frequency, by Provinces, was: Coclé 26.4 percent, Colón 17.4 percent, Chiriquí 61.5 percent, Bocas del Toro 5.2 percent, Veraguas 67.5 percent, Herrera 26.9 percent, Los Santos 62.8 percent, Panamá 15.8 percent, and Darién 8.3 percent. These figures are similar to those reported previously by Reverte in his surveys in the Provinces of Herrera, Veraguas, Coclé, Panamá, and Colón (55-59).

Paraguay. Of 13,000 school children between the ages of 6 and 16 years examined in 35 towns of this country, 30 percent had endemic goiter (60). Extensive examinations carried out by national health service physicians indicated a relatively high frequency of goiter and a considerable number of children with suggestive signs of cretinism (61).

Perú. In 1938 Burga Hurtado (62) reported a goiter prevalence of 90 percent in the lower zones and 30 percent in the higher altitudes in the Department of the Amazon. Salazar published an extensive monograph in 1952 (63) on personal investigations for the northern, central, and southern areas of the country, in-

cluding parts of the coast, mountains, and jungles. He found an overall goiter prevalence of 36 percent in men and 64 percent in women, as well as cretins, idiots, and some deaf-mutes. Burga Hurtado (64,65) has reported that in some areas of the Province of Rodríguez de Mendoza the prevalence reached 100 percent, while in the Department of Ancash it was less than 10 percent. The highest prevalence was found at altitudes between 1,000 and 3,000 meters.

Uruguay. In spite of previous reports that endemic goiter does not exist in Uruguay, a survey by Bauza and others (66) among school children in five of the eastern Departments of the country showed that endemic goiter prevalence varied between 6 and 17 percent.

Venezuela. In 1941 (67) a questionnaire concerning goiter was filled out by the authorities in a number of towns. Eight of the replies indicated a prevalence of endemic goiter greater than 10 percent. La Grita with 47 percent, Guarico with 28 percent, and Monte Carmelo with 25 percent, had the highest frequencies among the localities that responded. In La Grita, cretinism was reported in 2 percent of the school children, and four other towns also reported cases of both cretinism and deaf-mutism. In a study of endemic goiter which included uptake of labeled iodine (I^{131}), Roche and others (68) reported that the community of Bailadores, situated in the western mountains of the country, showed a prevalence of 81 percent in adult men, 89 percent in adult women, 77 percent in boys, and 85 percent in girls.

Caribbean Islands. The clinical nutrition surveys that have been carried out in Jamaica, Cuba, Haiti, Puerto Rico, and other islands of the Caribbean do not list endemic goiter as a public health problem.

Effectiveness of Salt Iodization

One of the best demonstrations of the effectiveness of the iodization of common salt for the prevention of endemic goiter carried out anywhere in the world has been reported by Gónzora and Mejía Caicedo (5). In the Province of Caldas, Colombia, the distribution of salt iodized with potassium iodate at a level of 1 part of iodine in 20,000 parts of salt resulted in

a decrease in the prevalence of goiter from 83.1 percent among 8,000 school children in 1945 to 33 percent among 6,500 in 1952. Confirmation of the effectiveness of iodine supplied at the level obtained by salt iodization in the prevention of goiter under conditions prevailing in Latin America comes from the studies in El Salvador and Guatemala (6). Five milligrams of iodine given once a week in tablet form, either as potassium iodide or potassium iodate, resulted in a very marked reduction in the prevalence of goiter among school children in periods as short as 15 weeks. No change was observed in groups given placebos. Goiter returned during the school vacation when iodine administration could not be continued.

The significance of this study was in the demonstration that potassium iodate is sufficiently stable to be added to crude, moist salt without the necessity for either refining or special packaging (6). Stacpoole has also reported good results with salt sprayed with potassium iodate and administered to 200 school children in San Andrés, Totopac, Mexico (52). On the basis of these studies, the third conference (3) recommended "that when a dry refined salt containing suitable stabilizers and protected from moisture cannot be conveniently and economically distributed, potassium iodate should be employed for iodization," and most technically underdeveloped areas are now using or plan to use potassium iodate rather than potassium iodide for the iodization of salt. It is hoped that in the next few years reports of repeat surveys will be published after national iodization programs have been introduced.

There is no definite information available on the operation of goitrogenic factors in Latin America. Thus far, iodine administration has been effective in reducing goiter prevalence wherever it has been tried, but the levels employed have been 5 to 10 times higher than in Europe. The natural levels of iodine in some freshly produced salt samples in areas of Latin America where goiter is highly prevalent approach the level of 1 part in 100,000 recommended by the WHO study group which met in London in 1952 (46). The third conference took the position that salt iodization for Latin America should be at a level of not more than the 1 part in 10,000 used in the United States

and Canada, and not less than the 1 part in 20,000 used successfully in Colombia. Until clear-cut evidence is available that lower levels are equally effective and that goitrogenic factors are not important in Latin America, this seems a reasonable recommendation in view of its low cost and complete safety.

Lowenstein (10) has reported the results of a longitudinal nutrition study among 75 families representing 347 persons living in the Brazilian Amazon community of Belterra whose extremely low cash income was increased threefold from 1955 to 1956 with a corresponding marked improvement in dietary intake of essential nutrients. Coincident with this change the size of the goiters decreased although there was no significant change in overall prevalence. The author believes the changes to have been due to the general nutritional improvement rather than increased dietary iodine content alone, but no analyses of dietary iodine were made. An unpublished study by the National Institute of Nutrition of Ecuador reported that half of 200 individuals in 5 villages had 24-hour urinary iodine excretions below normal limits. Since some individuals with goiter had values which were apparently normal, the authors suspect that goitrogenic factors may be contributing to endemic goiter in this area. Individuals with goiter were found consistently to have abnormally rapid uptakes of labeled iodine (I^{131}).

Progress of Salt Iodization in Latin America

In Paraguay, effective and complete iodization of salt with potassium iodate is required by law and is carried out under the direct supervision of the nutrition section of the health department. In Guatemala, compulsory iodization of salt with potassium iodate was begun in 1958 and is now reasonably complete. At the time of the fourth Latin American nutrition conference in 1957, legislation requiring the iodization of all salt had also been passed by Colombia, Costa Rica, Ecuador, and Panama, but was not yet enforced. In addition, Argentina, Brazil, and Uruguay had legislation requiring the iodization of salt for those regions in which goiter was a public health problem. This has been defined as a prevalence greater

than 10 percent. Nearly all the other countries have legislation pending to require salt iodization, but delays have been due not only to inertia, but also to the very real difficulty of arranging for iodization of the output of a large number of very small producers. Continued slow but steady progress toward salt iodization throughout Latin America can be anticipated.

Conclusions

Endemic goiter occurs as a serious health problem in the countries of Bolivia, Colombia, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panamá, Paraguay, Perú, and Venezuela, and in extensive areas of Argentina, Brazil, Chile, and Uruguay. Since it is known to occur also in the United States and Canada, it is thus a problem of concern to all of the Americas. Cretinism, deaf-mutism, and feeble-mindedness are frequently reported in association with a high prevalence of endemic goiter, but there is still no direct evidence for causal relationship.

The importance of salt iodization as a preventive measure is widely recognized, and legislation requiring it is already in effect in 9 of the 20 Latin American countries, although it has not yet been put into practice in all of them. The level of iodization recommended for Latin America by successive nutrition conferences is not less than 1 part of iodine in 20,000 and not more than 1 part in 10,000 parts of salt. The former proved effective in Colombia and the latter is used in the United States and Canada; both are higher than used in Europe. While environmental goitrogenic factors are presumed to increase requirements for iodine in Latin America, there is only speculation as to their possible nature or relative importance. In general, potassium iodate is preferred because it is stable when added to crude moist salt and it requires no special refining or packaging.

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